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October 4, 1999

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

HAND DELIVERED

Ms. Magalie Salas, Secretary
Federal Communications Commission
445 12th Street SW, Room TW-B204
Washington DC 20554

703-812-0440
lazarus@fhh-telecomlaw.com

Re: ET Docket No. 99-231
Amendment of Part 15 of the Commission's Rules
Regarding Spread Spectrum Devices

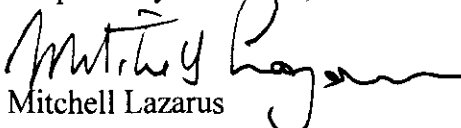
Dear Ms. Salas:

Enclosed please find the original and nine copies of the Comments of Clearwire Technologies, Inc., for filing in the above-referenced docket.

Please date stamp and return the enclosed extra copy of the Comments.

If further information is necessary, please call me at the number above.

Respectfully submitted,



Mitchell Lazarus

Counsel for Clearwire Technologies, Inc.

ML:deb

Enclosures

cc: Thomas F. Daley, Esquire, Clearwire Technologies, Inc.
Mr. David C. Chauncey, Clearwire Technologies, Inc.
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ORIGINAL

Before the
Federal Communications Commission
Washington DC 20554

In the Matter of)
)
Amendment of Part 15 of the Commission's) ET Docket No. 99-231
Rules Regarding Spread Spectrum Devices)

COMMENTS OF CLEARWIRE TECHNOLOGIES, INC.

Clearwire Technologies, Inc. (Clearwire) respectfully files these Comments on the Notice of Proposed Rule Making in the above-captioned proceeding.¹

INTRODUCTION

Summary of Position. Clearwire strongly opposes the Home RF Working Group (HRFWG) proposal for wideband frequency-hopping systems. HRFWG equipment would cause undue interference to systems that comply with the present rules, without offering reliably better performance.

Clearwire endorses the comments filed today by the Wireless Ethernet Compatibility Alliance (WECA). Clearwire is not a WECA member, but its views in this proceeding are nonetheless closely aligned with WECA's. Rather than burden the record with a duplicative pleading, Clearwire instead will only add and emphasize the points set out below.

Clearwire supports the idea of a Gaussian interferer jamming test in principle, but the present proposal is too vague for evaluation. Clearwire urges the Commission to defer promulgating a rule until it can provide a more specific Further Notice.

¹ Amendment of Part 15 of the Commission's Rules Regarding Spread Spectrum Devices, ET Docket No. 99-231, Notice of Proposed Rule Making, FCC 99-149 (released June 24, 1999) (Notice).

Clearwire does not oppose the Commission's proposal to specify that an applicant using a jamming margin test to qualify a system with a spreading rate of less than 10 chips/symbol must submit test results with a calculation of system processing gain.

About Clearwire. Clearwire provides wireless Internet and other network access using 2.4 GHz spread spectrum technology.² Clearwire both manufactures equipment for this application and sells the service to Internet service providers and other network providers, which resell to end users. Clearwire service was first offered commercially in April 1999 in the Dallas, TX, and Buffalo, NY, markets. Clearwire plans to add 2-3 markets before the end of 1999, and another 25 markets during 2000.

The Clearwire application uses a point-to-point configuration in which one base station site serves hundreds of end users. The system transmits Internet protocol (TCP/IP) over an Ethernet interface, across distances ranging up to 25 miles (40 km). An end user can transmit and receive simultaneously at preselected speeds ranging from 128 to 640 Kbps.

Clearwire transmitters are certified at 190 milliwatts, well under the permitted one-watt maximum. Antenna gains vary from zero to 17 dBi — also well under the permitted maximum at this power level. Service is nonetheless extremely reliable, in part thanks to the interference avoidance algorithms discussed below.

² Clearwire is a privately held company, founded in 1998 as a spin-off from Sierra Technologies, Inc. In addition to its Dallas headquarters, the company operates a technology center in Buffalo, New York.

A. The Commission Should Not Certify Wideband Frequency Hopping Systems.

Clearwire supports rule changes that enable more sophisticated technologies to increase the capabilities of individual systems, and to increase the capacity of the spectrum they share. But the present Notice would not accomplish either of these goals. To the contrary, it represents an unpromising effort by some manufacturers to squeeze higher data rates out of less sophisticated equipment at the expense of others in the band. The Commission should reject the proposal.

Specifically, HRFWG asked the Commission to certify 2.4 GHz frequency hopping systems at bandwidths of 3 and 5 MHz, in addition to the present 1 MHz.³ These wider bandwidths will necessarily overlap on successive hops, and hence will occupy each frequency in the band for more time, by a factor of 3 or 5, than a 1 MHz frequency hopper does. This will result in harmful interference to conventional direct sequence and frequency hopping systems.

HRFWG proposes to mitigate the excess interference by subjecting wideband operation to lower maximum powers — 320 mW for a 3 MHz system, and 200 mW for a 5 MHz system — and by requiring shorter occupancy times. Both measures will not only be ineffective, but counterproductive.

In principle, lower powers might conceivably help to protect a conventional system running nearby at a full watt. But in fact most spread spectrum systems (including Clearwire's) operate at far lower powers. Reducing HRFWG power to 200 mW will not protect a Clearwire

³ Letter from Ben Manny, Chairman, HRFWG, to Dale Hatfield, FCC (Nov. 11, 1998) (HRFWG Letter).

unit trying to receive a 190 mW transmitter 25 miles away. Instead, HRFWG will force other users to step up their own power, which is not conducive to effective sharing of the spectrum. The Commission should not initiate a needless "arms race" among Part 15 users.

HRFWG's proposal for shorter occupancy times not only fails to reduce interference, but would actually worsen it. Although the occupancy times would be reduced, the measurement period for those occupancy times would also be reduced, in exact proportion.⁴ As a result, the overall percentage of time each channel is occupied would remain the same — but each occupied channel would be 3 or 5 times wider. Any given frequency would be occupied more of the time, by a factor of 3 or 5, and so would be subject to that much more interference.

Worse, however, the shorter occupancy times necessarily translate to a higher hopping rate. That would actually increase interference, for two reasons. First, a higher hopping rate increases the probability of collision, and hence directly raises the incidence of interference.⁵ Second, and more important, an overly high hopping rate would frustrate more sophisticated systems, such as Clearwire's, that can otherwise use interference cancellation algorithms to maintain reliable operation despite the presence of other users. The Commission should affirmatively encourage the use of such systems, which promote higher densities of band usage,

⁴ HRFWG proposes the following:

1 MHz bandwidth: 0.4 secs. within a 30 sec. period
3 MHz bandwidth: 0.05 secs. within a 3.75 sec. period
5 MHz bandwidth: 0.02 secs. within a 1.5 sec. period.

⁵ Jim Zyren, *Analysis of WBFH Power Reduction and Increased Hop Rate on Other Users of the 2.45 GHz ISM Band*, attachment to Letter from James T. Carlo *et al.*, IEEE, to Magalie R. Salas, Secretary, FCC (electronic filing Oct. 2, 1999).

rather than authorize more primitive technologies whose interference cannot be avoided.

Although the rules presently permit higher hopping rates, for the Commission to make them compulsory — by requiring shorter occupancy times — would be counterproductive as an interference reduction measure.

Finally, as the WECA filing shows in detail, wideband frequency hoppers cannot achieve enough performance gains over conventional 1 MHz equipment to justify the interference they would cause to other users. Multipath distortion caused by reflections over room-size distances (10-20 feet) will slow the data rate of wideband receivers to levels more typical of conventional frequency hoppers.⁶ Implementation of the HRFWG proposal would thus impair existing equipment without yielding any benefit to the public.

The public interest simply cannot justify this threat to existing users for the sake of a technology that is incapable of delivering an adequate return. The balance of public interest tilts heavily against the HRFWG proposal, and the Commission should reject it.

B. The Proposal For a Gaussian Interferer Jamming Margin Test Is Promising but Premature.

Clearwire generally supports flexibility in test procedures, consistent with limiting certification to true spread spectrum devices. Manufacturers need maximum flexibility to address the public's evolving needs for communications equipment, while the Commission has

⁶ See Jim Zyren & Pierre Gandolfo, *Simulation of WBFH Multipath Performance* (Intersil Corp., electronic filing Oct. 4, 1999). Multipath distortion is due to reflections from building walls or other surfaces. The reflected signal takes a longer path than the direct signal, and so arrives at the receiver later, where it interferes with the direct signal. Multipath distortion affects different frequencies differently, reinforcing some and canceling others. A 3 or 5 MHz passband is wide enough for multipath effects to cause peaks and valleys across the band that interfere with high-speed data.

the responsibility of affording maximum protection to the band. Approval of the CW jamming margin test, for example, satisfied both policies by making possible new classes of products without significantly increasing interference to those already in use.

The proposed Gaussian noise interferer jamming margin test may likewise ultimately prove to be advantageous, by providing a more realistic simulation of interference rejection than the CW test does. But the Notice does not permit this determination, because it does not yet specify the test in sufficient detail.

Clearwire agrees with WECA that the Commission should treat the present notice of the Gaussian interferer test as a Notice of Inquiry, and use the ongoing round of comments and reply comments to develop a Further Notice of Proposed Rule Making. The Further Notice should provide enough technical specifics so that parties can compare equipment that passes the Gaussian jammer test with that passing present tests, predict interference rejection, and evaluate those predictions experimentally. These steps are necessary for proper consideration of a proposed test, but cannot be performed with the sparse information in the present Notice.⁷

CONCLUSION

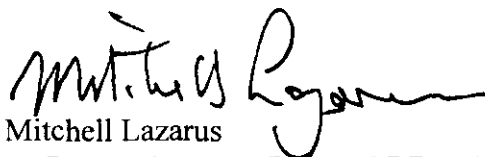
The Commission should firmly reject the HRFWG proposal for wideband frequency-hopping systems. Not only will HRFWG equipment cause undue interference to both direct sequence and frequency hopping systems that comply with the present rules, but will not offer reliably better performance than existing equipment does. In particular, the Commission should

⁷ The IEEE concurs. See Letter from James T. Carlo *et al.*, IEEE, to Magalie R. Salas, FCC (electronic filing Oct. 2, 1999).

not authorize equipment that frustrates sophisticated interference cancellation algorithms otherwise capable of promoting denser use of the band.

The Commission's proposal of a Gaussian interferer jamming test is promising, but is not yet sufficiently developed for evaluation as a proposed rule. The Commission should defer detailed consideration until it can distill proposals raised in this round of comments into a more specific Further Notice.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mitchell Lazarus". The signature is fluid and cursive, with the first name "Mitchell" written in a larger, more prominent script than the last name "Lazarus".

Mitchell Lazarus
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1300 North 17th Street, 11th Floor
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703-812-0440

October 4, 1999

Counsel for Clearwire Technologies, Inc.

CERTIFICATE OF SERVICE

I, Deborah N. Lunt, a secretary for the law firm of Fletcher, Heald & Hildreth, P.L.C., hereby certify that a true copy of the foregoing "Comments of Clearwire Technologies, Inc." was hand delivered this 4th day of October, 1999, to the following:

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Washington, D.C. 20554

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Federal Communications Commission
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Washington, D.C. 20554

Commissioner Michael Powell
Federal Communications Commission
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Commissioner Susan Ness
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Commissioner Gloria Tristani
Federal Communications Commission
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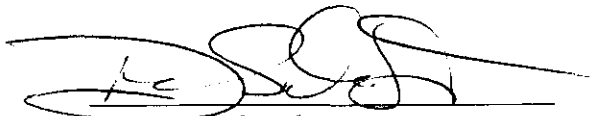
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